Ontario Energy Board

Regulated Price Plan Working Group Meeting #3

October 20, 2004

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Historical Seasonal HOEP

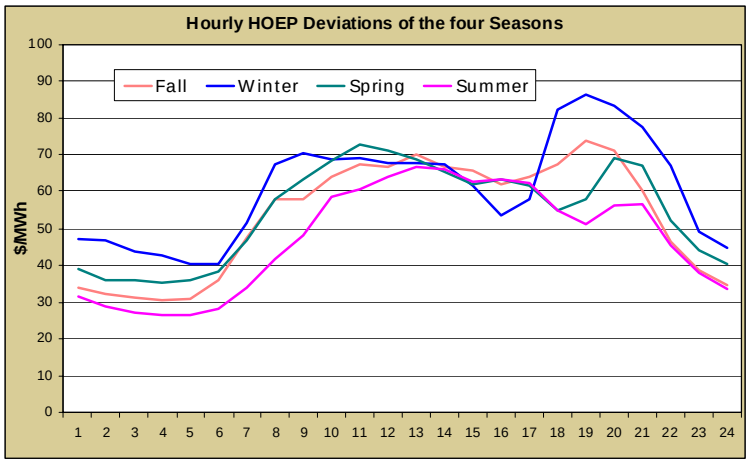

Chart from IMO, showing average hourly prices in the four seasons

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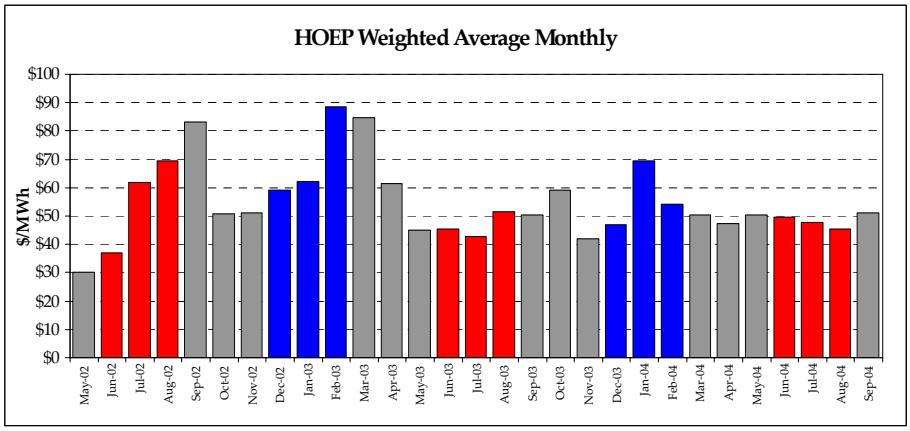
Historical Monthly HOEP



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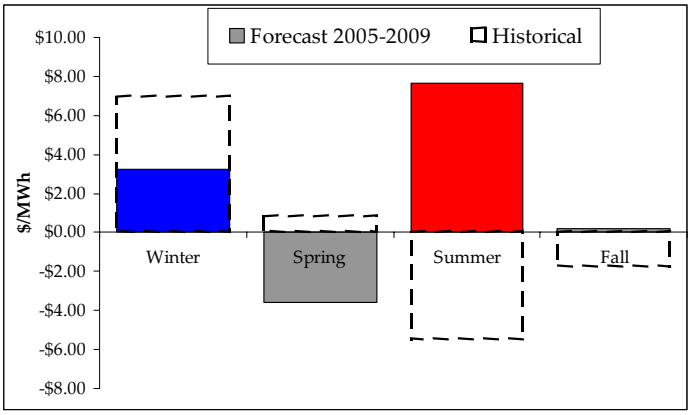
Historical vs. Forecast Quarterly Price Patterns



The historical patterns differ significantly from forecast, reflecting actual supply and demand conditions.

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Discussion Outline

- Purpose and Assumptions of Strawmen Development
- Methodology for Variance Development
- Strawmen Discussions
  - Description of strawmen
  - Price results for strawmen
- Description of Variance Modeling

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Purpose of Strawmen Development

- The discussions of the working group have developed a range of tools for the design of the RPP
- Discussions have identified a number of objectives of the RPP, and some conflict between objectives
- The strawmen are developed to test the application of the tools to the achievement of the objectives
  - In some cases, aspects of the strawmen are included to test extremes
  - Other aspects of the strawmen are intended to test interaction among the design choices
- The purpose of the strawmen is to provide a basis for discussion and further testing of tools, to help reach understanding of how the objectives can be met
- We have also produced quantitative results to help the working group compare the possible price patterns under each of the strawmen, as tested against a range of possible variance outcomes

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Assumptions for Strawmen Development

- No true ups or other price changes in first year of RPP
  - May need some specific provisions for the transition from the first to the second year of RPP
- RPP will be designed for 4/5 years
- Initial strawmen will not incorporate pricing schemes requiring smart meters (for example, Critical Peak Pricing)
  - Smart meter implications will be dealt with after this basic approach is outlined
- Assume residential and small business customers are eligible for RPP
- No price bias built into the RPP for these strawmen; this tool would be compatible with any of them
  - Using one of the strawmen, we have tested a price bias by showing a quantitative result if we assumed a price bias

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Variance Simulations

- This discussion can be better informed by having a set of variances against which to measure the performance of the strawmen
- The previous variances came from scenarios, which are scripted as chosen by Navigant Consulting
- For this analysis, we wanted to derive variances using a more formal probabilistic methodology, letting random effects generate the variances with enough repetition to allow clear patterns to emerge
- A description of our methodology follows the discussion of the quantitative results

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Variance Simulations

- The next two slides show the aggregate results of our variance simulations
- We ran the simulation with 1000 random trials
- To illustrate the performance of the strawmen, we chose five of the simulations:
  - Two extremes (at about the 10% and 90% levels)
  - Two medium (at about the 25% and the 75% levels)
  - One central result (at about the 50% level)
- In the slides, variances which the customers will have to pay are labeled "unfavorable"; those which are to their credit are labeled "favorable"

Note: The levels are where these particular simulations fall in the range of the 1000 performed. That is, the 10% level is a simulation with a variance more unfavorable than 90% of the runs, etc.

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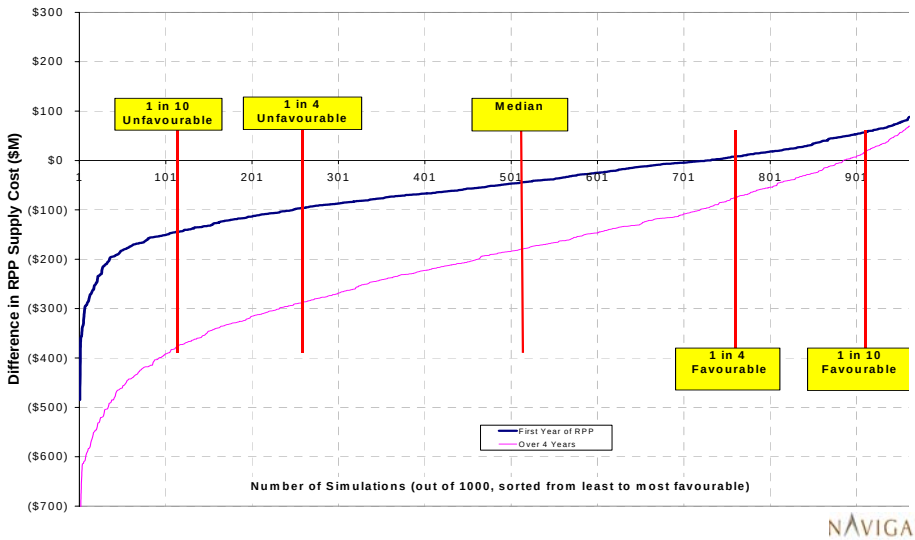
Supply Cost Differences from the Simulation



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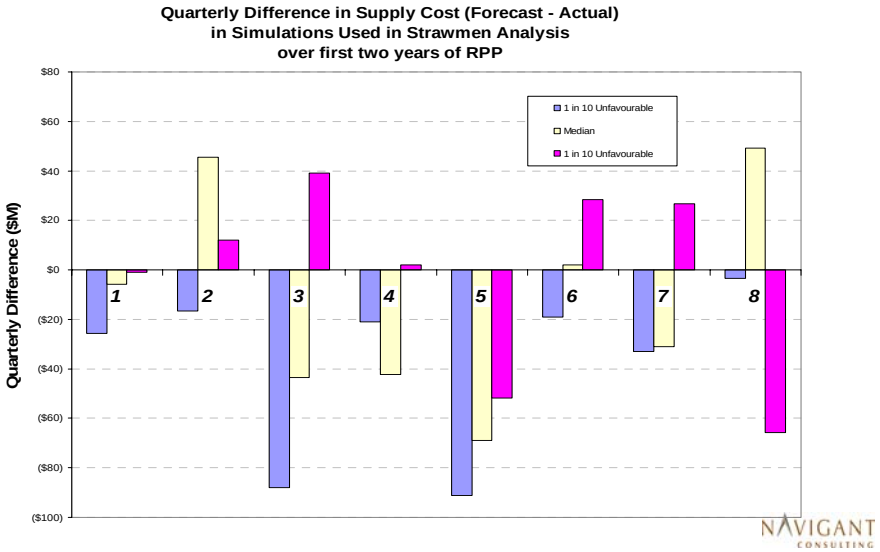
Simulation Results



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Strawmen

- We have compiled four strawmen to test the aspects of the application of the tools to the objectives
- The strawmen are driven by basic themes
  - Minimize change from present conditions
  - Maximize cost reflectivity
  - Balanced
  - Maximize price stability

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Minimize Change

- Least change from present conditions for eligible customers
- Easy for eligible customers to understand
- Designed for consumer acceptance

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Minimize Change: Strawman

- True up:
  - Every 12 months of the variance accumulated in the previous year
- Rebase:
  - Every 12 months
- Recovery period:
  - Variances collected over 12 months following true up
- Variance calculation period and notice:
  - One month calculation time
  - Two months notice
  - For both rebasing and true ups

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Minimize Change: Strawman

- Price tiers:
  - Two tiers, modeled after two existing tiers
- Seasonal pricing:
  - No seasonal pricing
- Entry/exit
  - Variances not cleared on exit
  - 12 month minimum time for exit to competitive retailer, unless retailer defaults
  - New customers pay same rates as existing customers
- Second-year transition:
  - Variances cleared as for regular true ups/rebasing
- Residential and small business classes:
  - All eligible customers pay the same for energy
- Simulations:
  - This strawman was simulated both with a price bias to account for stochastic effects and without a price bias

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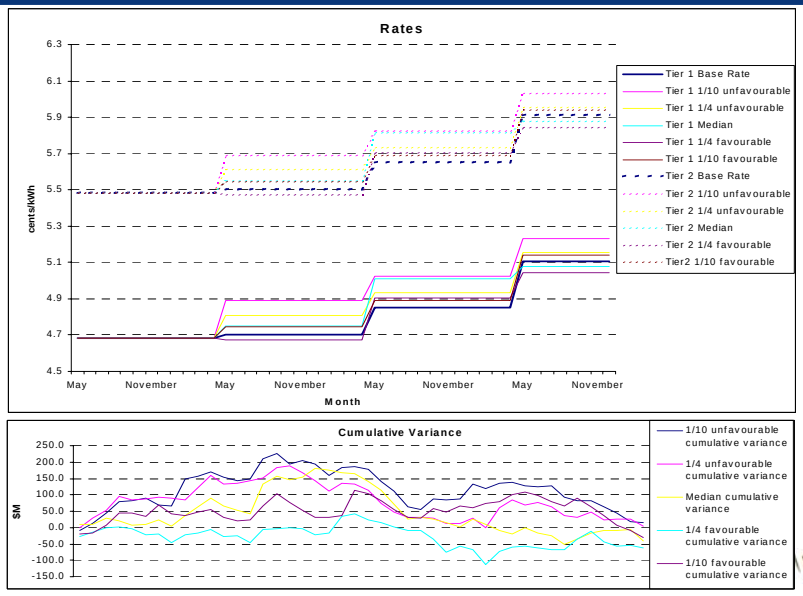
Minimize Change Strawman: Price Simulations without Price Bias



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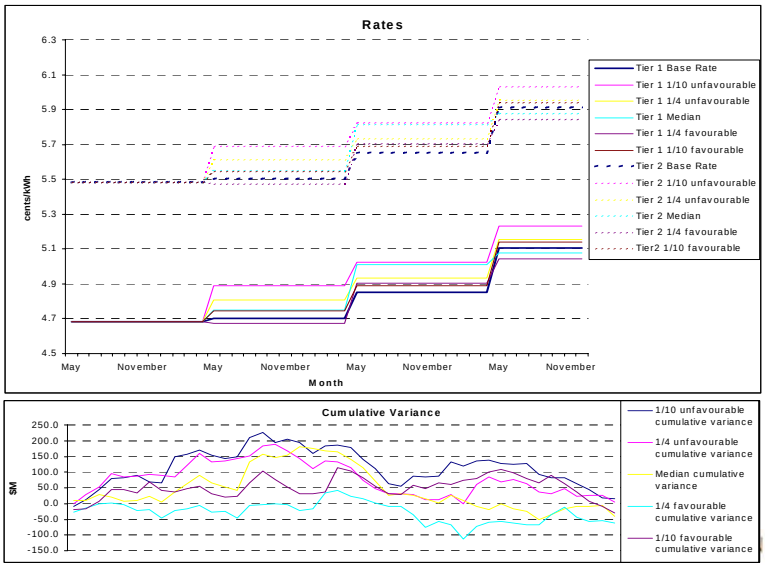
Minimize Change Strawman: Price Simulations with Price Bias



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Maximize Cost Reflectivity

- Set prices to marginal cost where possible
- Prices track known cost patterns where possible
- Identified customers pay costs incurred for their supply

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Cost Reflectivity: Strawman

- True Ups:
  - Quarterly true ups of variances accumulated in the quarter, done one month before end of quarter and based on estimate for whole quarter
- Rebase:
  - Review quarterly, implement based on change in underlying cost conditions as determined by OEB and on accumulated variances, with intention to clear all variances by end of fiscal year.
- Recovery period:
  - Variances cleared in each fiscal year
    - True ups collect past variances
    - Anticipated future variances avoided by rebasing.
    - End of year correction clears all variances remaining by then by recovering any remaining Q4 variance in Q1 of next year.

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Cost Reflectivity: Strawman

- Variance calculation period and notice:
  - Amount of true up/rebasing determined one month before end of quarter, based on actual and estimated data
  - Three weeks notice to customers; true up/rebasing implemented at beginning of next rate season.
- Tiers:
  - Three tiers. Second tier designed to reflect marginal price in peak season, top tier to reflect marginal price at system peak
  - Tier structure is seasonal; see next slide

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Cost Reflectivity: Strawman

- Seasonal:
  - Seasonal prices. Three seasons, summer, winter, off-peak. Highest prices for summer, then winter, then off-peak
  - Third tier only applies in peak seasons, summer and winter
- Entry/exit:
  - All accumulated and estimated variances cleared on leaving for competitive retailer or for customers leaving LDC territory
  - Customers leaving for competitive retailers must remain off default supply for 12 months, unless retailer defaults
  - New and returning customers do not pay for past variances; that is, they do not pay for past true ups.

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Cost Reflectivity: Strawman

- Second-year transition:
  - Clear all variances within six months of transition
- Residential and small business classes:
  - All eligible customers pay the same for energy in first two tiers.
  - Top tier designed to increase prices for larger eligible business customers and for larger residential customers
  - Top tier only applies in peak seasons
  - Tier threshold is higher for business customers
    - For example, 1500 kWh per month for residential and 3000 kWh per month for commercial customers

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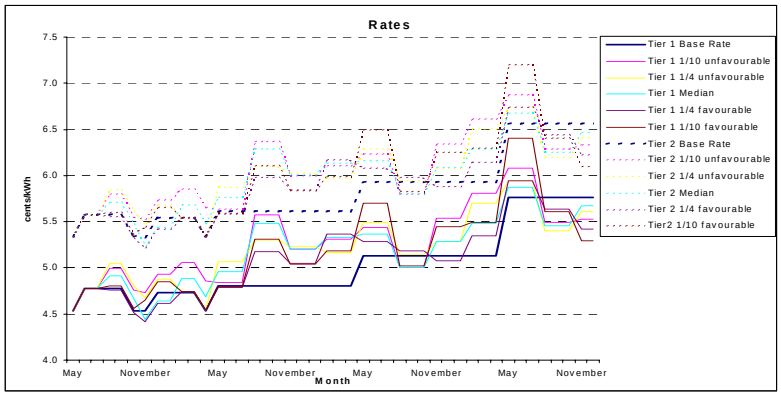
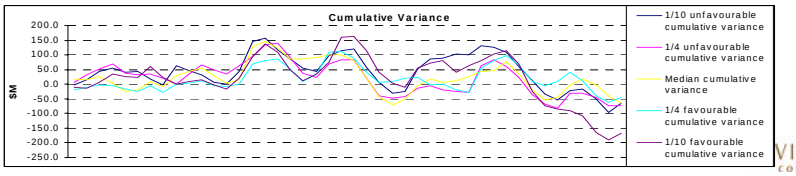
Cost-Reflective Strawman: Price Simulations





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Balanced Strawman

- Choose a mix of options that takes balanced approach to meeting the objectives
- Maintain customer acceptance
- Reasonable cost reflectivity, price stability

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Balanced Strawman: Strawman

- True up:
  - Quarterly review. True up only on materiality trigger
  - True ups based on total accumulated variance
- Rebase:
  - Review quarterly, rebase on expectation of expected material change in underlying cost conditions
  - Rebasing and true ups considered together quarterly
- Recovery period
  - True up amount set to collect total accumulated variance over 12 months from true up
  - Recovery is a rolling 12 months
- Variance calculation period and notice:
  - Calculation period one month
  - Notice 2 months
  - Both true ups and rebasing

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Balanced Strawman: Strawman

- Tiers:
  - Two tiers, top tier designed to reflect peak prices
- Seasonal pricing:
  - Two seasons, peak and off peak, applied only to top tier
- Entry/exit:
  - All accumulated variances cleared on customer exit to competitive retailer
  - No collection from customer leaving LDC area
  - New and returning customers pay same rates as existing customers
- Second-year transition:
  - Accumulated variances paid over 12 months
- Residential and small business classes:
  - All customer classes pay the same for energy

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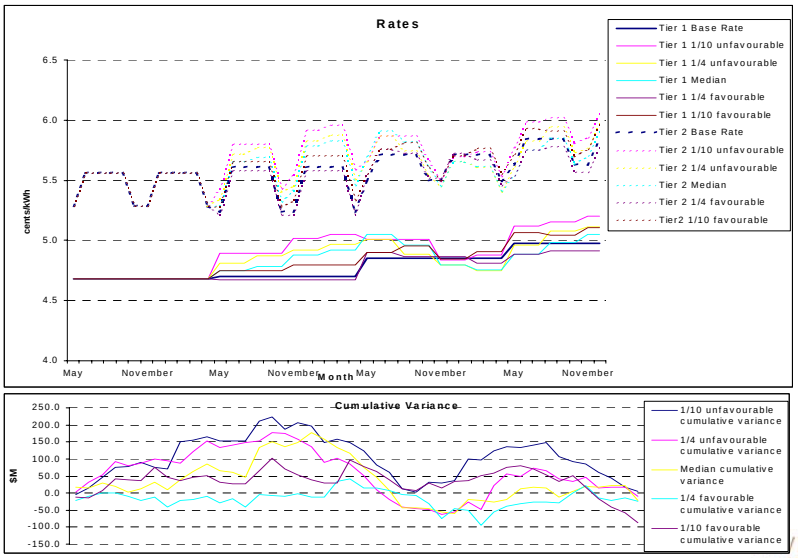
Balanced Strawman: Price Simulations



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Maximize Price Stability

- Maximum price increase per year (6%)
- No price increase greater than 2% in any quarter within a given year
- From Q4 of one year to Q1 of the next, any unused portion of the 6% annual maximum can be added, if needed

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Maximize Price Stability: Strawman

- True ups:
  - True up quarterly of total accumulated variances
  - If full true up would exceed maximum price change, set change at maximum and anything not recovered is captured in the cumulative variance for the next quarter
  - If accumulated variance is negative (actual costs below forecast), the negative variance is accumulated, not trued up immediately
- Rebase:
  - Annually, based on forecasts
  - If rebase plus true up would exceed maximum price change, rebase takes precedence and un-trued up variance accumulates
- Recovery period:
  - Target of 12 months, but carryover of variance could prolong it
- Variance calculation period and notice:
  - True up calculation lags actuals by one month
  - Five months notice time from calculation, so price changes (true ups or rebase) are six months from end of period
- Tiers:
  - One tier

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Maximize Price Stability: Strawman

- Seasonal prices:
  - Prices not differentiated by season
- Entry and exit:
  - Accumulated known and estimated variances cleared when customers leave for competitive retailer
  - Customers leaving for competitive retailer cannot return for one year, unless retailer defaults
  - Accumulated variances not cleared when customers move away from LDC area
  - New and returning customers pay the same prices as existing
- Second-year transition:
  - Maximum price adjustment is the 6% annual limit
  - Accumulated variances paid over 12 month recovery period, unless full recovery would violate limit price; then recovery extended as long as needed
- Residential and small business classes:
  - Both classes pay the same price for energy

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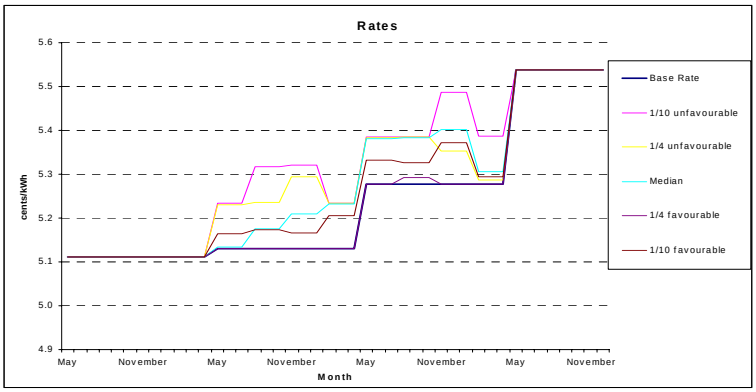
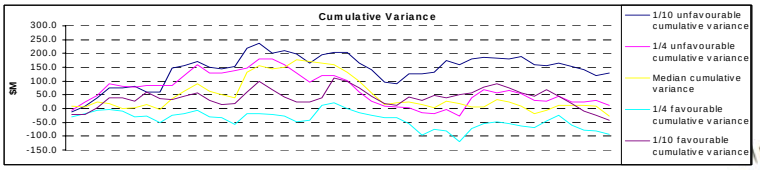
Price Stability Strawman: Price Simulation





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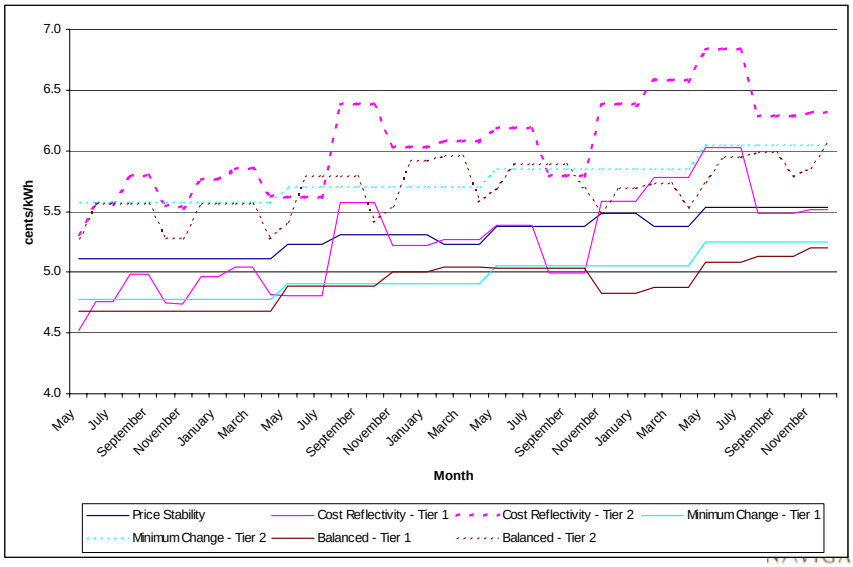
Comparison of 1 in 10 Unfavorable Results



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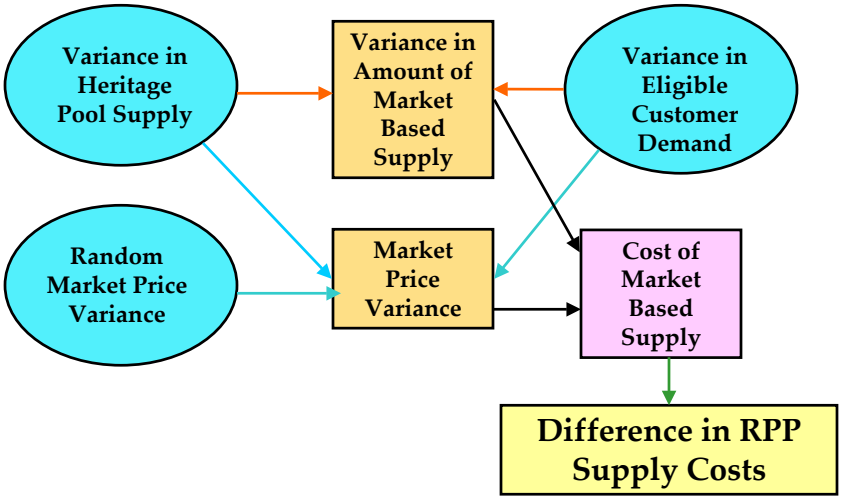
Variance Model



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Methodology for Variance Calculations

- To analyze these strawmen, we adopted a more formal probabilistic analysis of the possible variances
- Rather than construct scenarios, which estimated probabilities on an informal basis, we analyzed the factors causing variance, the relationships between them, and their probabilities
  - The previous methodology assumed values of these factors; this methodology uses statistical techniques to get their values based on their probabilities
- We then used these relationships and probabilities to simulate the system's generation of variance
- We simulated a large number of cases (one thousand) to get a quantitative sense of the range of variance outcomes

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Factors Creating the Variance

- The RPP will be based on a forecast of the factors which can affect the cost of RPP supply
- The simulated variances occur when the simulated outcomes for those factors differ from their forecast values
- To create the variances, we modeled those factors which are more likely to produce price variances
  - Those we modeled are the the amount of supply available from designated assets, the total demand by customers eligible for the RPP, and the market price of electricity.
  - Other factors that could create variances include natural gas prices, the cost and level of supply from existing NUGs and the cost and level of supply from contracts under the current and any future RFPs. These we took at the values in our current forecast.

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Supply: OPG Baseload Nuclear and Hydro

- For this calculation, we assumed that the OPG baseload assets will be supplied at a fixed price set by the OEB
- However, the quantities of output could be reduced or increased by worse or better than expected nuclear performance or hydro generation due to water flows
- For the nuclear units, we generated outage probabilities based on the outage rates assumed in our forecast
  - The outages simulated were in addition to the maintenance and forced outages already assumed in the price forecast
- For the hydraulic units, we generated outage probabilities based on the information from OPG on actual versus forecast hydro generation

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Demand: Demand by Eligible Customers

- The factor for modeling demand was weather
  - Other factors which could influence demand include overall economic effects, like income levels, size and numbers of households and small businesses, and the number and kind of appliances the customers have. We did not simulate these.
- Weather effects create the highest seasonal variances
- To model the weather, we obtained data on actual historical weather
- From those data, we constructed a probability distribution of weather (temperature only)
- In the simulation, the random weather effect was translated into an effect on demand using the IMO's information on the demand impact of heating and cooling degree days
- We assigned most of the heating load variance to RPP customers; we assigned less, but still more than half, of the cooling load variance to non-RPP customers

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RPP Supply Costs

- For the analysis, we assumed that the quantity of supply to be priced at the market is the residual of total demand from RPP eligible customers after the contribution of the prescribed generators, NUGs, and RFP contracts
- That quantity of supply will be higher than forecast if
  - Supply from the prescribed generators (nuclear, baseload hydro) is lower than forecast
  - Demand from the eligible customers is higher than forecast
- The quantity will be lower than forecast for the reverse conditions
- If the market price is above the cost of this supply, increasing that portion of supply will produce an unfavorable variance in the RPP supply cost

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Market Price: Calculation

- As the diagram showed, the quantity of supply from the designated resources and the quantity of demand both influence variance in two ways
  - Through their effect on the quantity of RPP supply that must be priced at the market
  - Through their effect on the market price itself
- We modeled these two effects by estimating the impact of changes in supply and demand on market price
- For this, we created a statistical model of the historical relationship between Ontario market price and Ontario supply, demand, and the natural gas price
- We used this statistical model to produce a market price, given the values of supply and demand from the random model

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Market Price: Random Factors

- These demand and heritage supply factors do not capture all of the uncertainty in market price
- Therefore, we separately analyzed the past pattern of Ontario market prices and created a probability distribution of those prices
- To model the unexplained random variance in Ontario market price, we drew from this probability distribution

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Market Price: Total Price

- The market price used for the variance calculations is a blend of these two sources of simulated market prices, each of which has a random component:
  - The price calculated from the conditions of supply and demand. These conditions are randomly generated.
  - The price from a random draw of the Ontario market price itself
- We weighted these two prices evenly, to reflect the level of explanatory power exhibited by our statistical estimation of the impact of demand and supply on price

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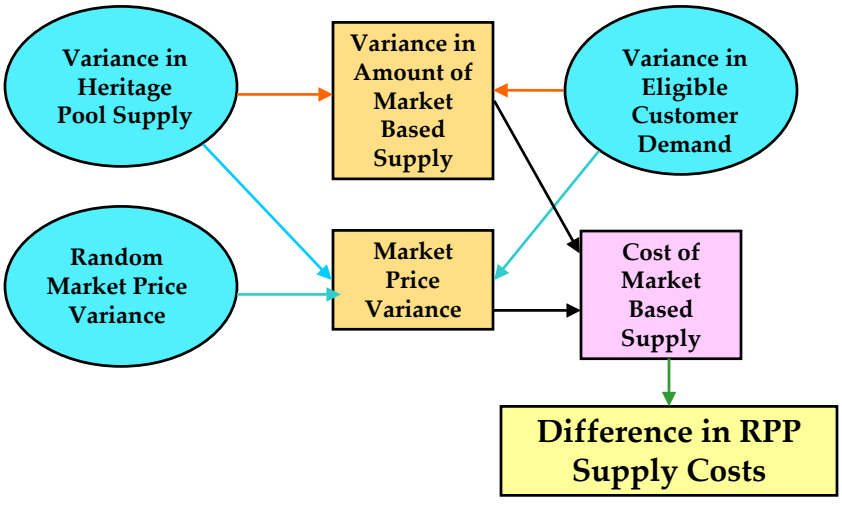
Variance Model



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